PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-231883
(43)Date of publication of application : 05.09.1995

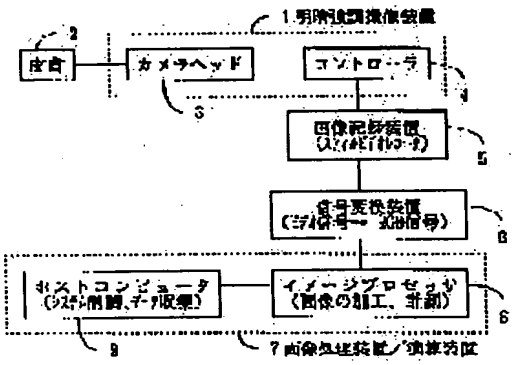
(51)Int.Cl. A61B 5/107
A61B 5/00

(21)Application number : 06-051195
(22)Date of filing : 23.02.1994

(71)Applicant : KANEBO LTD
(72)Inventor : MATSUE KOJI

(54) SKIN SURFACE ANALYZING SYSTEM, AND SKIN SURFACE ANALYZING METHOD

(57)Abstract:
PURPOSE: To provide a skin surface analyzing system and a skin surface analyzing method in which optical beauty of skin can be expressed numerically objectively and quantitatively.
CONSTITUTION: A two-dimensional sample image in which fine shade distribution in a surface of sample skin 2 is intensified is taken by a shade intensifying camera device 1, the two-dimensional sample image is processed by an image processor 8, and a high brightness part is extracted for performing particle analysis. A host computer 9 then calculates characteristic values correlated with optical beauty of the surface of the sample skin 2 based on the result of the particle analysis.



LEGAL STATUS

[Date of request for examination] 03.09.1999
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number] 3236731
[Date of registration] 28.09.2001
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The skin surface analysis system which consists the light-and-darkness emphasis image pick-up equipment which picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin front face was emphasized, the image processing system which carries out processing processing of this 2-dimensional sample image, extracts a high brightness part, and performs particle analysis, and a particle analysis result of an arithmetic unit which computes a total and the characteristic value which carries out data processing, and which is correlated with the optical beauty of a sample skin front face.
[Claim 2] The skin surface analysis system according to claim 1 with which an arithmetic unit computes a high brightness aspect product ratio as a characteristic value which carries out the total correlation to the optical beauty of the skin.
[Claim 3] The skin surface analysis system according to claim 1 with which an arithmetic unit computes the high brightness aspect product ratio per particle piece as a characteristic value which carries out the total correlation to the optical beauty of the skin.
[Claim 4] The skin surface analysis approach including the procedure which picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin front face was emphasized, the procedure of carrying out processing processing of this 2-dimensional sample image, extracting a high brightness part, and performing particle analysis, and the procedure which measures a total and the characteristic value which carries out data processing, and which is correlated with the optical beauty of a sample skin front face for a particle analysis result.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to a skin surface analysis system and the skin surface analysis approach, in more detail, detects the description on the front face of the skin, and relates to the analysis system and the analysis approach of carrying out assay of the irregularity on the front face of the skin, or the reflection of light.
[0002]
[Description of the Prior Art] the skins, such as a wrinkling from viewpoints, such as cosmetics and makeup, and a texture, — it is very important to evaluate and quantify description, skin quality, etc. Observing visually the image which the replica method which imprints a skin front face as an approach of detecting the shape of skin surface type using a suitable ingredient, and the approach of carrying out the expansion on-the-spot photo of the skin front face with a direct camera etc. were taken, and was obtained by these approaches, and evaluating it conventionally, was performed. Although such technique was used abundantly since it was simple and easy, it was difficult about catching the shape of complicated skin surface type to a detailed point, identifying it objective and quantifying it.
[0003] Then, in order to plan much more skin surface type-like feature extraction in recent years, skin surface information is processed using a computer etc. and evaluation and the pattern-ized technique are developed variously. That is, the image information which picturized a skin front face and its replica with the suitable photo-electric-conversion means, and was obtained is analyzed using a pattern processing program, and the shape of skin surface type etc. is evaluated objective and quantitatively. For example, to JP,60-53121,A and JP,61-64232,A, a skin replica is illuminated by two or more light sources, and the equipment which extracts the pattern of a leather slot and analyzes leather slot spacing, the direction of a leather slot, etc. is indicated. Moreover, the method of capturing a direct image from a skin front face, without using a replica, carrying out binarization processing of this, and performing pattern analysis to JP,64-59145,A is indicated, and after carrying out gradation processing of the replica photography image, the method which carries out an image processing and obtains the data about a hide channel depth is indicated by JP,2-46833,A. Furthermore, the method which carries out the monitor of the binarization image and measures a leather slot or the wrinkling depth is indicated by JP,60-63030,A, changing threshold level to a skin image.
[0004]
[Problem(s) to be Solved by the Invention] as a gestalt of the skin, there are a wrinkling and a texture (a leather slot — and — leather — the detailed irregularity called a hill), and about the appraisal method on such morphology, as mentioned above, many conventional techniques are known. and these conventional techniques — a wrinkling and a leather slot — and — leather — the gestalt of a hill is made applicable [for direct measurement] to analysis. On the other hand, the property which we recognize as a wrinkling or a texture with the naked eye is the difference of the light and darkness of the bright part as for which light is hit and made to the irregularity of the skin, and a dark part, and has not caught the detailed gestalt itself. However, the conventional skin surface analysis method mentioned above was not what all evaluate the granularity of this sensuous wrinkling and texture as.
[0005] Drawing 1 expresses typically how whose irregularity on the front face of the skin is visible. If the light 102 from a certain fixed direction hits to the surface irregularity of the skin 101 as shown in this drawing, the part 103 equivalent to which light is, and the part 104 not hitting will be made. And it is thought that human being recognizes as irregularity the visual difference of the bright part 103 equivalent to which this light is, and the dark part 104 not hitting, i.e., the difference of lightness.
[0006] In order to show the skin beautifully and healthily, while it is not finely conspicuous and carrying out a wrinkling and a texture generally, making it the sebum secreted by the skin front face not appear as TEKARI is considered as the important point. However, flesh color is prepared or it is known for one of these that the foundation which covers a stain, a freckle, etc. also highlights a wrinkling and a texture depending on the raw material blended. That is, since a part dark with the foundation as dark a part as a part bright when an one direction to light hits with the foundation using the pigment high [of a regular reflectance] so much is divided clearly, and using the pigment conversely large [of diffuse reflection] so much also becomes bright by diffuse reflection and the difference of light and darkness becomes small, it can be conspicuous in neither a wrinkling nor a texture, and it can carry out.
[0007] Moreover, when foundation is used, it is known that the problem of "messy makeup" will arise. This "messy makeup" takes place by the sebum mainly secreted by the skin front face, and can roughly be divided into four phenomena as follows. First, if sebum is secreted by the passage of time on a skin front face, the front face of a pigment will wet wet by the sebum, the reflection which a pigment has will be lost, and it will be sensed that the complexion became dark. This is the first stage story of "messy makeup", and is called "******" or "dullness." Thus, a wrinkling and a texture come to be conspicuous when the reflection which a pigment has is lost. And if secretion of sebum progresses further, sebum itself will make the condition of calling specular reflection a lifting and "TEKARI." Furthermore, if secretion of sebum progresses, the pigment on the skin sinks into sebum, or will be in the condition of floating on sebum. It is in the condition that this is called a "fat float." Moreover, the phenomenon called "depend" happens in a part with motions, such as an outer canthus and the month. Since the motion joined the condition of the above "a fat float", this [a pigment's] can be partial and is in the condition from which deviation arose. Thus, although there are the four above-mentioned phenomena in "messy

makeup", it is said also in it that especially "TEKARI" and a "fat float" are the element most important when making those who use foundation recognize "messy makeup."
[0008] A deer is carried out, and in order to develop the foundation which shows the skin continuously beautifully and healthily, in addition to exact grasp of the property of each raw material, the new appraisal method which evaluates foundation will be needed. Then, this invention aims at offer of the skin surface analysis system which evaluates objective and quantitatively, the visual granularity of the irregularity of the skin, and the homogeneity of the lightness distribution in the skin front face of "TEKARI" by sebum secretion, and a "fat float", i.e., the optical beauty of the skin, and the skin surface analysis approach.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention provided the following means. That is, the skin surface analysis system concerning this invention consists of a total and an arithmetic unit which compute the characteristic value which carries out data processing, and which is correlated with the optical beauty of a sample skin front face in the light-and-darkness emphasis image pick-up equipment which picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin front face was emphasized, the image processing system which carries out processing processing of this 2-dimensional sample image, extracts a high brightness part, and performs particle analysis, and a particle analysis result. And the above-mentioned arithmetic unit shall compute a high brightness aspect product ratio and the high brightness aspect product ratio per particle piece as a characteristic value which carries out the total correlation to the optical beauty of the skin. Moreover, the skin surface analysis approach concerning this invention consists the procedure which picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin front face was emphasized, the procedure carry out processing processing of this 2-dimensional sample image, extract a high brightness part, and perform particle analysis, and a particle analysis result of a total and a procedure which measures the characteristic value which carries out data processing, and which is correlated with the optical beauty of a sample skin front face.
[0010]
[Function] According to this invention which takes the above-mentioned configuration, the 2-dimensional sample image which also emphasized the difference in the slight contrast which cannot be caught with the naked eye can be picturized using light-and-darkness emphasis image pick-up equipment. And the sample image which emphasized the difference between the bright part made by irregularity with the detailed skin and a dark part, i.e., the vanity of a wrinkling or a texture, can be obtained by using this light-and-darkness emphasis image pick-up equipment. Moreover, since this light-and-darkness emphasis image pick-up equipment is used, when there is a part which produced TEKARI and a fat float by the sebum secreted by the skin front face, the sample image which emphasized TEKARI of that part and a fat float can also be obtained. And since he is trying to compute the characteristic value which carries out processing processing of this 2-dimensional sample image, extracts a high brightness part, performs particle analysis, carries out data processing of that particle analysis result, and is correlated with the optical beauty of a sample skin front face, The acquired characteristic value becomes sensuous evaluation of the beauty of the appearance of the skin, and the thing which has very high functionality, and becomes possible [evaluating the beauty of the appearance of the skin objective therefore].
[0011]
[Example] Hereafter, the suitable example of this invention is explained to a detail with reference to a drawing. Drawing 2 is the block diagram showing the fundamental configuration of the skin surface analysis system concerning this invention. As shown in this drawing, this skin surface analysis system is equipped with light-and-darkness emphasis image pick-up equipment (1), and picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin (2) front face was emphasized. This light-and-darkness emphasis image pick-up equipment (1) serves as a camera head (3) from a controller (4), for example, can use "the super eye C2847 (the Hamamatsu photonics company make)." The above-mentioned camera head (3) consists of the large camera tube of a dynamic range, and a controller (4) performs differential processing of the image pick-up signal outputted from the above-mentioned camera head (3). That is, only a high region frequency component is amplified and the display even of the fine thing which cannot usually carry out macro-scopic observation is enabled vividly. And adjustable setting of the differential time constant can be carried out to a multistage story, and it can choose the optimal Mohd now according to the spatial frequency of a photographic subject.

[0012] Image recording equipments (5), such as a stere videocassette recorder, are connected to the above-mentioned light-and-darkness emphasis image pick-up equipment (1), and record-keeping of the 2-dimensional image sample image data is carried out by this image recording equipment (5). Moreover, the signal converter (6) is connected to image recording equipment (5), and the 2-dimensional sample image data currently recorded as a video signal by this signal converter (6) is changed into the RGB code suitable for the graphic display of a computer.
[0013] Furthermore, the image processing system/arithmetic unit (7) is connected to the above-mentioned signal converter (6). This image processing system/arithmetic unit (7) carry out processing processing of the 2-dimensional sample image inputted in the form of an RGB code, and it computes the characteristic value which carries out data processing of this particle analysis result, and is correlated with the optical beauty of a sample skin (2) front face while it extracts a high brightness part and performs particle analysis. As this characteristic value, a high brightness aspect product ratio and the high brightness aspect product ratio per particle piece are contained. This image processing system/arithmetic unit (7) consist of combination of an image processor (8) and a host computer (9), and an image processor (8) extracts the high brightness part of an image, and, specifically, performs particle analysis while it performs smoothing processing for noise reduction of the image which was constituted as a subject and inputted in the image analyzer NEXUS6800 (product made from NEXUS) etc. And a host computer (9) performs data processing, data collection, etc. of a particle analysis result while controlling the whole system.
[0014] Drawing 3 shows an example of the 2-dimensional sample image which photoed the frame after performing makeup by foundation with the above-mentioned light-and-darkness emphasis image pick-up equipment (1), and was obtained. It becomes possible to emphasize and take a photograph to the difference in the delicate contrast which cannot be caught with the naked eye by performing differential processing to the video signal acquired from the camera head so that clearly from this drawing. Therefore, the

image which emphasized a wrinkling, the vanity of a texture, TEKARI by sebum, and a fat float can be obtained by using this light-and-darkness emphasis image pick-up equipment (1).

[0015] The example of the image which photoed the sample skin front face to usual is shown in drawing 4 for reference. If this drawing is compared with drawing 3 , by the usual photography image, contrast with a detailed skin front face cannot be recognized, therefore effective information about TEKARI or the fat float by the vanity and sebum of a wrinkling or a texture cannot be acquired so that clearly.

[0016] Next, with reference to drawing 5 , actuation and operation of the skin surface analysis system shown in drawing 2 are explained to a detail. First, in step S1, the light-and-darkness emphasis image of a sample skin (2) front face is photoed with light-and-darkness emphasis image pick-up equipment (1). Under the present circumstances, since the illuminance and incident angle of the illumination light influence the brightness of a photography image greatly, it is desirable to take a photograph, after optimizing lighting conditions about each sample skin (2) front face. Next, in step S2, the need is accepted, and the 2-dimensional sample image with which detailed light-and-darkness distribution was emphasized is once recorded and saved to image recording equipment (5). And in step S3, after changing the original video signal into the RGB code which was suitable for graphic display with the signal converter (6), a 2-dimensional sample image is inputted into an image processor (8) by step S4. Next, in step S5, processing processing of the inputted above-mentioned 2-dimensional sample image is performed, and smoothing processing for noise reduction of an image etc. is performed.

[0017] Subsequently, in step S6, a measurement field is specified if needed. Assignment of this measurement field is performed when measuring about the same part of the 2-dimensional sample image extracted serially, and it is performed using a keyboard or a digitizer, observing the monitor of the above-mentioned image processor (8). For example, when investigating how the beauty of the appearance of the skin which applied foundation passes, and it sometimes follows, and changes, detection sensitivity can be raised by measuring by specifying the field with which it laps completely.

[0018] After an appropriate time, in step S7, binarization processing or threshold processing is performed and the high brightness part corresponding to the bright part produced with detailed irregularity and the part which produced TEKARI and a fat float is extracted. This binarization processing is performed by the above-mentioned image processor (8), and that lightness is classified to white and black for every pixel of an image as compared with a predetermined threshold. And the emphasis extract of each high brightness part is carried out by this judgment, and the so-called particle is obtained. The example of the image of the particle obtained by this binarization processing by drawing 6 is shown. (A) of drawing 6 is the image before performing binarization processing, and the bright part shows the measurement field. Moreover, (B) of drawing 6 performs binarization processing to above-mentioned drawing 6 (A), and extracts the high brightness part to which a white part is called a particle.

[0019] Next, particle analysis is performed in step S8. That is, while measuring the sum total and the number of area of a particle which were extracted as mentioned above, when a measurement field is specified, the area of this measurement appointed field is also measured. And in step S9, the measurement data which the host computer (9) mentioned above is incorporated from an image processor (8), and the ratio (a high brightness aspect product ratio is called hereafter) of the sum total of the area of the extracted particle over the whole surface product of the inputted image or the area of the measurement appointed field is computed. This high brightness aspect product ratio is obtained by /(sum total of area of extracted particle) (whole surface product [of the inputted image], or area of measurement appointed field) x100. Moreover, the average percentage (the high brightness aspect product ratio per particle is called hereafter) of the area per [to the whole surface product of the inputted image or the area of the measurement appointed field / which was extracted] particle piece is computed. The high brightness aspect product ratio per this particle is obtained by /(sum total of area of extracted particle) (whole surface product [of the inputted image], or area of measurement appointed field)]/(number of extracted particle) x100.

[0020] In order to perform evaluation of the skin surface analysis system concerning this invention, and the skin surface analysis approach finally, correlation with actual measurement data and the evaluation result of having evaluated extent of messy makeup by naked-eye view and feelings sensuously was investigated. First, two kinds of foundations of a commercial item and a prototype were applied to right and left of five female test subjects' face, and the light-and-darkness emphasis image of a frame was photoed 3 hours immediately after spreading, after [of spreading] 90 minutes, and after spreading. As a lens, macro lens FD100mm of canon and f4 were used, and the lighting system for photographs which made the metal halide lamp of 575W the light source as illumination light was used. The illuminance of the photography part at this time was about 5000 luxs.

[0021] And the questionnaire about messy makeup was performed to photography and coincidence of the above-mentioned light-and-darkness emphasis image to the test subject, and extent of messy makeup was scored. The item used for the questionnaire was made into four phenomena of expressing the condition of messy makeup, and about the score showing each item and its extent, it was carried out as shown in Table 1.

[0022]

[Table 1]

程　度	アンケート項目 色沈み	テカリ	よれ	脂浮き
全く気にならない	1	1	1	1
気にならない	2	2	2	2
少し気になる	3	3	3	3
気になる	4	4	4	4
非常に気になる	5	5	5	5

[0023] many characteristic values mentioned above about the differential emphasis image of the photoed frame — measuring — the above — correlation with sensuous evaluation was searched for. The result is shown in Table 2.
[0024]
[Table 2]

アンケート項　目	高輝度部面積比率	粒子1個当たりの高輝度部面積比率
色沈み	-0.0565	0.0285
テカリ	0.5482*	0.5385*
よれ	0.0054	0.2218
脂浮き	0.4960*	0.4672*

*: — significant at 5% or less of level of significance — [0025] A questionnaire item is shown in the left-hand side of this table 2, and the correlation coefficient with two characteristic values is shown in right-hand side. Two measured characteristic values had high correlation intentionally with the item of "TEKARI" and a "fat float", and it was proved from this that the item and correlation relevant to reflection of the light of a pigment were high so that this table might be seen and might be known. Since it was the item which is a change minuter than "TEKARI" and a "fat float", and cannot be easily recognized by the test subject about "******", either, and since it was not an item relevant to reflection of the light of a pigment in "depend", correlation is considered to be the low thing.
[0026] Next, "the optical beauty on the front face of the skin" which serves as a scale of "messy makeup" from the correlation type of the high "mutually related TEKARI" and mutually related "high brightness aspect product ratio" was especially computed to the above-mentioned result. The correlation formula is given by 2.487x(high brightness aspect product ratio)-0.6718.
[0027] The result of having performed comparative evaluation about two kinds of foundations mentioned above using this correlation type is shown in the graph of drawing 7 . In this graph, the elapsed time after applying foundation to an axis of abscissa was taken, and "the ratio of the optical beauty on the front face of the skin" was taken along the axis of ordinate. After the ratio of this optical beauty photos the image immediately after spreading and in the passage of time and computes "the optical beauty on the front face of the skin" about each foundation based on the above-mentioned correlation type, it takes both ratio. Therefore, this value expresses the variation of the optical beauty on the front face of the skin from immediately after foundation spreading.
[0028] If this graph is seen, the prototype of the variation of the optical beauty on the front face of the skin from immediately after spreading is larger than a commercial item, therefore it turns out that the inclination for a prototype "for makeup to come off" rather than a commercial item is shown. [tend] And this result was the result of the questionnaire mentioned above, and a match.
[0029]
[Effect of the Invention] As explained above, after this invention picturizes the 2-dimensional sample image with which detailed light-and-darkness distribution of a sample skin front face was emphasized and carries out processing processing of this, it computes a predetermined characteristic value by it extracting a high brightness part, performing particle analysis, and carrying out data processing of this particle analysis result. Since a deer is carried out and significant correlation is accepted between the analysis result of a differential emphasis image, and sensuous evaluation about "TEKARI" and the "fat float" in "messy makeup", it is clear that it is very useful as a means by which this invention can evaluate the optical beauty on the front face of the skin objective, and a means which can evaluate the effectiveness over "messy makeup" which the charge of makeup has objective.

[Translation done.]

* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram which is visible as for the wrinkling on the front face of the skin, or a texture, and explains the condition of the direction.
[Drawing 2] It is the block diagram showing the fundamental configuration of the skin surface analysis system concerning this invention.

[Drawing 3] It is the photograph in which the example of the 2-dimensional sample image with which light-and-darkness detailed distribution of a sample skin front face was emphasized is shown.
[Drawing 4] Usually, it is the photograph in which the example of the 2-dimensional sample image of the photoed sample skin front face is shown.
[Drawing 5] It is a flow chart explaining the procedure of the skin surface analysis approach concerning this invention.
[Drawing 6] It is the photograph in which the example of the image before binarization processing of the 2-dimensional sample image with which light-and-darkness detailed distribution of a sample skin front face was emphasized, and the image after binarization processing is shown.
[Drawing 7] It is the graph which shows the result of having computed change of the optical beauty on the front face of the skin after spreading, about two kinds of foundations.
[Description of Notations]
1 Light-and-Darkness Emphasis Image Pick-up Equipment
2 Sample Skin
3 Camera Head
4 Controller
5 Image Recording Equipment
6 Signal Converter
7 Image Processing System/Arithmetic Unit
8 Image Processor
9 Host Computer

[Translation done.]

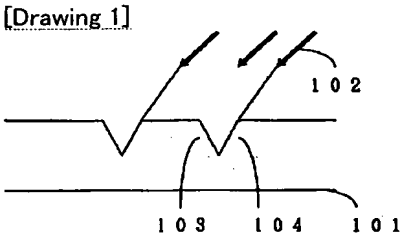
* NOTICES *

JPO and NCIPI are not responsible for any
damages caused by the use of this translation.

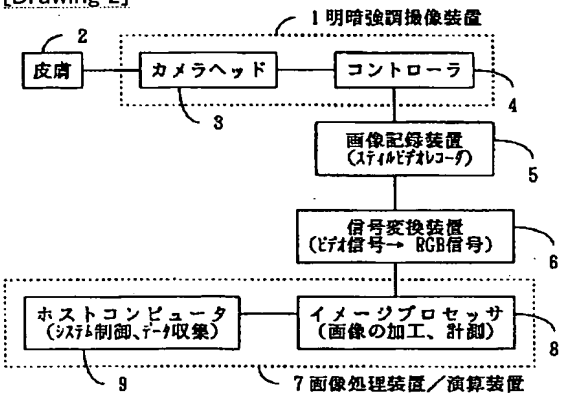
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

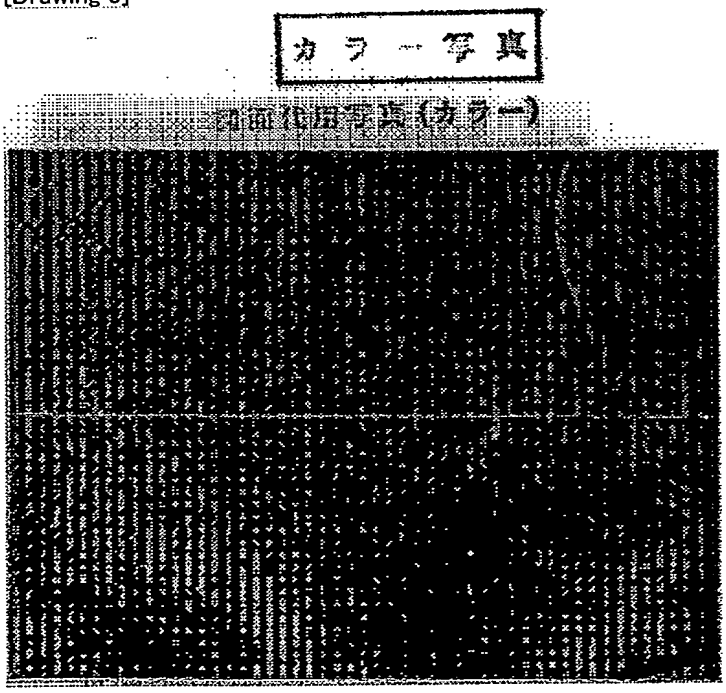
[Drawing 1]



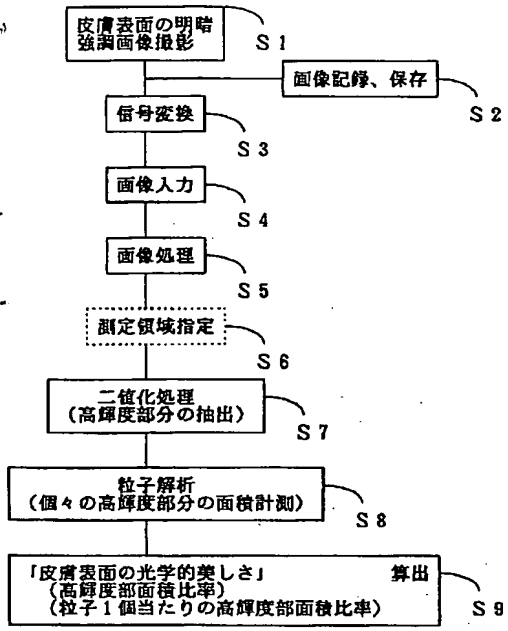
[Drawing 2]



[Drawing 3]

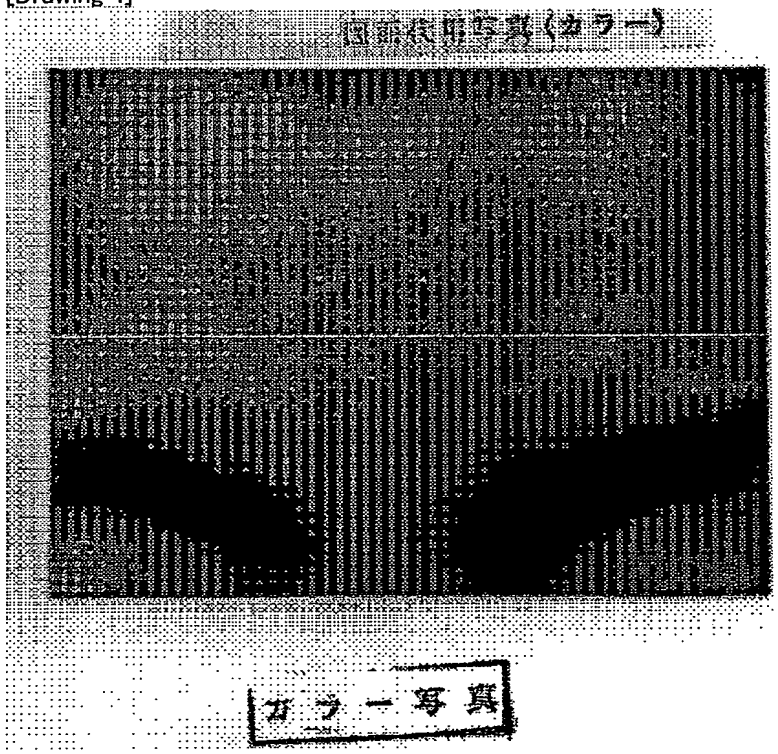


[Drawing 5]

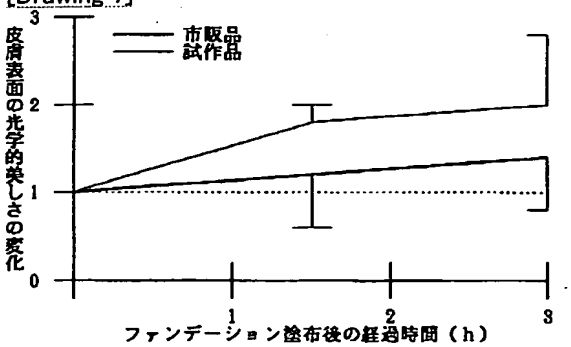


Best Available Copy

[Drawing 4]



[Drawing 7]



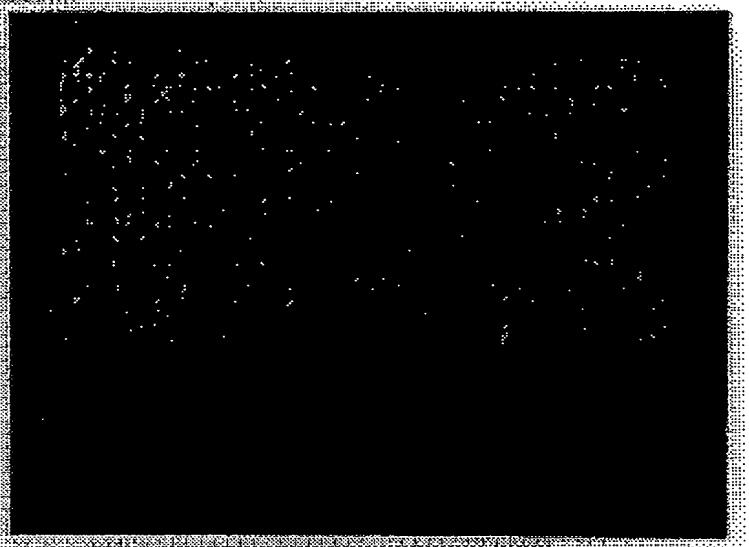
[Drawing 6]

カラー写真

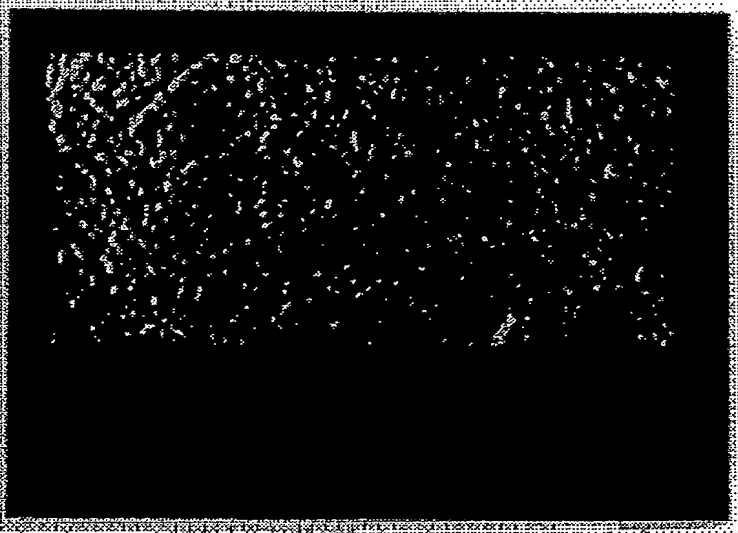
Best Available Copy

選択図用写真(カラー)

(A)



(B)



カラー写真

[Translation done.]